NATIONAL UNIVERSITY OF MODERN LANGUAGES

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BS COMPUTER SCIENCE III

Digital Logic Design

Universal Gates and Its Uses:

A gate is a fundamental component of a digital circuit that carries out a particular logical operation. A gate that may be used to make any other kind of gate is known as a universal gate. **NAND** gates and **NOR** gates are the two categories of universal gates.

NAND (Not-AND) Gates: Only when all of its inputs are low does a NAND gate produce a high output (1). (0). Any input that is high (1) will result in a low output (0). Because it may be used to create any digital circuit, the NAND gate is universal. Any other form of gate, such as AND, OR, NOT, and XOR gates, can be built using a combination of NAND gates.

NOR (Not-OR) Gates: Only when all of its inputs are low does a NOR gate produce a high output (1). (0). Any input that is high (1) will result in a low output (0). Because it may be used to create any digital circuit, the NOR gate is also universal. Any other gate type, such as AND, OR, NOT, and XOR gates, can be produced by combining NOR gates.

Any other form of gate can be built using either NOR or NAND gates. However, because they require fewer transistors than NOR gates and are more effective and less expensive to produce, NAND gates are more frequently utilised in contemporary digital circuits.

Truth Table AND Gate and OR Gate.

AND Gate

Input 1	Input 2	Input 3	Output
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

OR Gate

Input 1	Input 2	Input 3	Output
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

Truth Table NOR Gate and NAND Gate.

NOR Gate

A	B	C	Output
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

NAND Gate

A	B	C	Output
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

Truth Table XOR Gate and XNOR Gate.

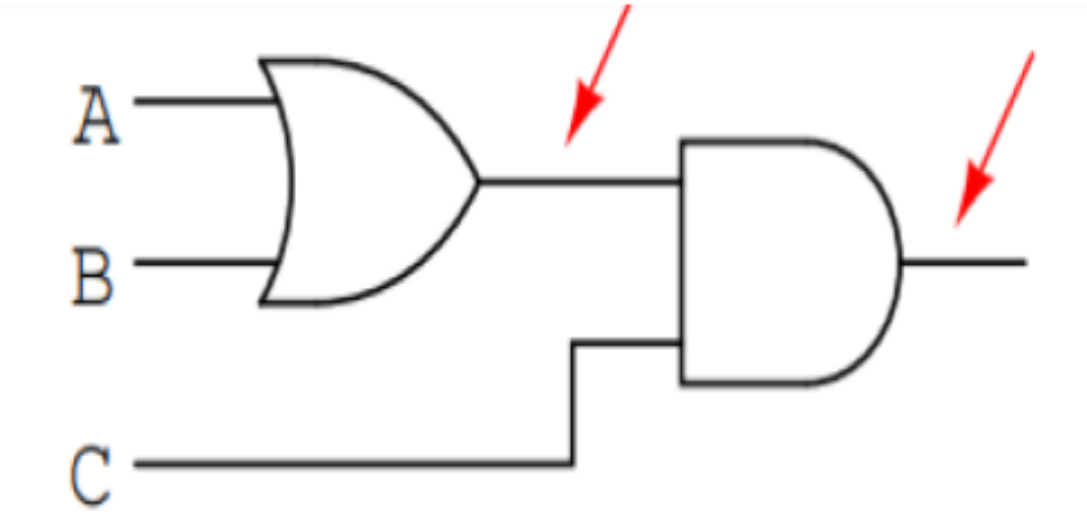
XOR Gates

A	B	C	Output
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

XNOR Gate

A	B	C	Output
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0

Convert the following logic gate circuit into a Boolean expression, writing Boolean sub-expressions next to each gate output in the diagram:



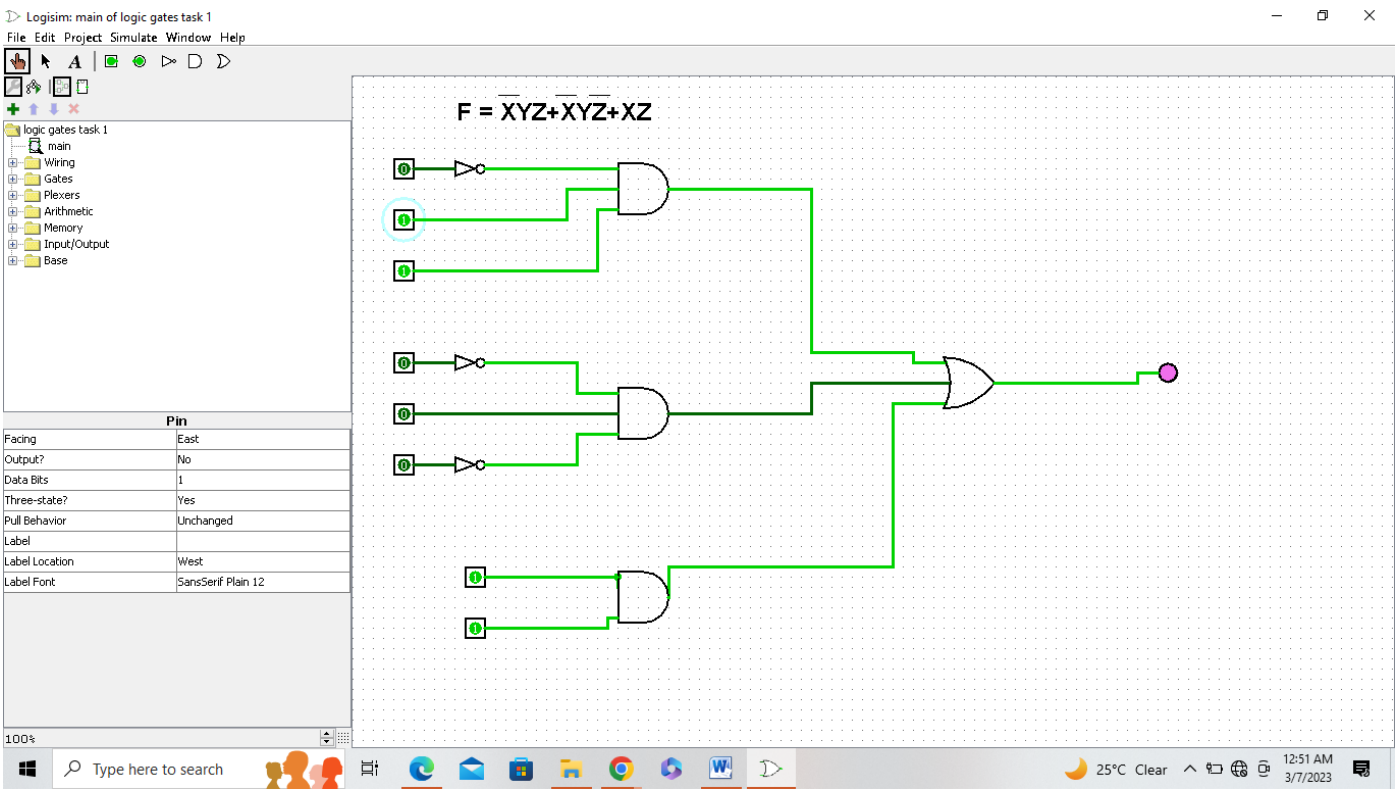
Answer

(A+B)+C

here is boolean expression of this Diagram

6. Draw the following function in Circuit maker.

1) F = $\bar{X}$YZ + $\bar{X}$Y$\bar{Z}$ + XZ



2) F=$\bar{X}$Z + X$\bar{Y}$Z +Y$\bar{Z}$